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THE ADDITION OF NITROGEN FERTILIZERS TO COMPOST

EHRENFRIED E. PFEIFFER

The suggestion has frequently been made of adding nitrogen fertilizers to composts to enrich the formula as well as to make the fertilizers more "palatable" as a commercial product. To appeal to the farmers who have been educated to think in terms of high nitrogen formulas. By "high" nitrogen we understand more than 4%, 8, 10, 12, 16 or more.

We have ourselves suggested, in the past, enriching a compost formula with a 1 to 2% N content by the addition of nitrogen compounds to raise the nitrogen to 3 and 4%.

According to publications which can be found here and there in the agricultural literature, experiment stations, in Alabama for instance, have found that 4% nitrogen in an organic fertilizer is about the upper limit of effectiveness and no higher yields have been obtained with higher nitrogen formulas when organic matter containing fertilizers (composts, manures) were used. This means that higher formulas only lead to excess nitrogen which in turn will be lost or merely superfluous.

This observation does not touch the problem of how far one should go with inorganic fertilizers with a high content of easily available nitrogen.

Fertilizer additions of inorganic compounds have been investigated with regard to compost enrichment and this is what we know at present.

Ammonium nitrate is not suitable as an admixture to organic composts because of the danger of spontaneous and internal combustion especially if the compost is dusty, powdery and of a low moisture content. Such mixtures draw moisture easily because they are hygroscopic and then begin to warm up, losing ammonia to a considerable extent.

Sulphate of ammonia, urea, calcium nitrate and Chilean nitrate are under consideration. Calcium nitrate is the best material for our purpose. However, the most common commercial product is a calcium-ammonium-nitrate for which the same rules apply as for any ammonium containing compound, the easy and too quick release of ammonia.

Calcium nitrate is suggested where there is in any case a deficiency in calcium. Microorganisms in vitro and vivo react favorably and especially nitrogen fixing organisms such as azotobacter, nitrosomonas and rhizobium require calcium.

However, the fact should always be borne in mind that nitrogen fixing organisms and nitrate formers work best when the available nitrogen is low. Every bacteriologist knows that these organisms are best grown on nitrogen free culture media. If available nitrogen is high they will not fix atmospheric nitrogen but begin to live on the nitrogen which is so easily offered to them, thus even creating nitrogen losses. Therefore, if one wants to make use of N fixing organisms one has to keep the available N low.

In composts where we need these organisms for the breakdown of organic matter and for the formation of a stable humus, the total N has thus to be kept in the lower brackets. It was our experience that a 2% total N and a 1.7% ammonia or nitrate content is the upper limit of N stability. It is possible that the N can go as high as 3 and 4%, but then the compost should be dry and not active. During the fermentation in a pile the N can be up to 2% and will remain, with a higher N the danger of ammonia and nitrite formation will lead to losses. Nitrites are especially dangerous because their concentration will lead to a poisoning state and prohibit the growth of microorganisms.

In a low nitrogen compost (between 0.8 and 1.4%), we have observed that with a proper composting technique and the use of our B.D. Compost Starter we have been able to increase the total nitrogen content sometimes by 70%, frequently by 40%. In other words, the actual fermentation is carried out best at lower N levels.

There is also, of course, a lower limit and we have found that compost with a total N level below 0.7% usually is "slow." For the fermentation of very low nitrogen containing materials such as sawdust, bagasse, straw, i.e. cellulose and lignin materials, the addition of nitrogen is mandatory in order to speed up the rotting. However the addition has to be done with great care and skill if one does not want to lose too much nitrogen or prohibit bacterial action.

Our present experience is that nitrogen source material with slowly available nitrogen, i.e. organic nitrogen, is far preferable to easily available nitrogen such as ammonia, nitrate, or urea, especially in regard to compost fermentation. In order to add and correct the N situation in a compost pile of low N content as mentioned, we suggest, therefore, the combination of a small amount of the above mentioned easily available nitrogen sources and a large amount of organic N deriving from hoof,

horn, blood, fish, i.e. animal sources, or rich plant sources, such as pea vines, castor bean pomace as well as poultry manure.

Occasionally we receive letters from people who report that their compost heaps heated up quickly and high (140°F) for the first 4 to 6 days and then suddenly came to a standstill. This has been observed with the addition of mineral N as well as with poultry manure. In these cases we had too fast a release of ammonia and especially of nitrites which in turn created an inhibiting situation in the pile as far as the microlife was concerned. We can only advise that care be taken with N corrections during the fermentation.

Another matter is the addition of nitrogen fertilizers to the finished product, the dehydrated organic fertilizer which was made from plant wastes, garbage, industrial wastes in general. We have tried the addition of ammonium sulphate and urea. If these mixtures are kept dry they will keep. If they draw moisture, they will heat up and lose ammonia.

Using a mixture of 4% N, half of which derived from added ammonium sulphate and/or urea and applying it to lawns and directly to the root area of tender plants (flowers), has caused burns especially on dry soils, under direct sun, and if watered down thoroughly. Too much N was released all at once. The safest bet would be to use a 3% N organic fertilizer made from compost, garbage, etc.

Most garbage composts are alkaline. Ammonium sulphate would acidify as it does in soil. This may be desirable in alkaline soils and for acid loving plants. In acid soils, such a compost would lose two of its main properties, neutralizing and buffering. Chilean nitrate, containing sodium, brings with it the danger of sodium accumulation, which is very damaging to alkaline soils.

The mechanism, resp. biochemistry, of compost and organic fertilizer application to soils should be fully understood by the farmer and the fertilizer salesman. Mineral fertilizers are concentrates and can be applied in small amounts, down to 100 lbs. per acre, drilled in the furrow, or as high as 800, 1000 or more pounds per acre. Therefore, they lend themselves easily to the use of higher concentrations of 8, 12, 16% and more, since the rate per acre can be reduced. The tendency recently is to increase the concentration for this reason. The tendency is also not to mix them with the topsoil any longer, but to apply them to the deeper layers of the soil and, as in the case of straight

ammonia, to the irrigation water. Either this, or the ground water in the subsoil will dilute the fertilizer so that harmful concentrations can be avoided. The advice is also frequently given to stay two inches away from the plant roots when applying as a side drill in row cultures.

It is evident that no burns would be produced with high N organic fertilizers if the same methods of application are used. It is, however, and this is a very important point, not in the nature and purpose of an organic fertilizer or compost to be applied as a fertilizer concentrate at 100, 200, or 500 pound level per acre. The composted fertilizer should carry a high percentage of organic matter for all the reasons we need organic matter in soil: as a soil conditioner, to improve the physical structure of the soil, to increase the water holding capacity of the soil, to increase the speed and rate of absorption, to provide food for the microorganisms in the soil, especially organic food which delivers the energy for the growth of the organism and to create specific growth conditions in the Rhizosphere of plants due to the growth of hormones, enzymes, vitamins (B 12), antibiotics contained naturally in a good, living compost.

These intrinsic values in addition to the organic matter and the inorganic nutrients make the compost-organic fertilizer valuable. They cannot be judged solely from the mineral NPK point of view. At least half of the dollars and cents value of a compost is represented by these intrinsic values. Organic-compost fertilizers therefore are not mineral concentrates. The more of them applied per acre the better it is for soil improvement. While the mineral concentrates have an upper toxic limit of concentration (lbs per acre) the composts have no upper limit. In both cases there is an economic limit as to cost per acre. The cost per ton is not necessarily a criterium and one cannot make comparisons of formulas and tonnage costs because of the entirely different natures of both types of fertilizers.

The practical application rates of composted fertilizers ranges between 1 and 3 tons/acre of air dry and dehydrated products and 5 to 7 tons of wet (50% moisture) products or even more, for instance for wet manures a figure of 10 tons/acre is the generally acknowledged application. At these rates the problem looks like this. A compost fertilizer with 1% total N, at the rate of 1 ton/acre provides 20 pounds of nitrogen, 2 tons/acre provides 40 pounds, and so on. If the N content is 2% these figures double, 40 and 80 pounds of N per acre which is

enough in most cases. Of a 3% N compost one would use 1000 pounds /acre and get 30 pounds of N, etc. This explains why it is not necessary from a practical point of view to increase the nitrogen content above the 3% level.

There is still another factor worth our consideration. In composted fertilizers most of the nitrogen is present in form of a stable organic nitrogen. This nitrogen is slowly but steadily released over a much longer period of time than the readily available ammonium or nitrate. Ammonia and nitrate are easily lost in the ground water, in rain or irrigation, as the plant roots do not make use of all of it at once. Only part of the ammonia and nitrate is preserved in the soil, namely that fraction which is absorbed by the natural soil humus or transformed by the microlife in soil. Only when a soil is dry no action whatsoever will occur. Again a soil with a high organic matter will stay moist longer into a drought than a mineralized soil. Many observations in this direction have been made recently. One frequent occurrence is that organic matter (and nitrogen) influence the plant growth favorably still at times nearer the harvest when other plants have already stopped growing. While excessive available ammonia and nitrates would push a plant to shoot up, to produce a lot of green mass, but to lag behind at maturing time, i.e. to ripen prematurely. The danger of lodging of grains exists when there is lots of rain and too easily available nitrogen, a danger which never occurs with the organic treatment.

The farmer and gardener has to become familiar with these fundamental differences then he will be able to apply the "low grade" organic formula to advantage. Organic N will be much longer lasting, in fact in soils with a high organic matter content the after effect will still be evident in the second, sometimes even in the third year, so that a new application is not needed every year. If combined with a conserving crop rotation with legumes this lasting effect can be extended even further.

Due to the entirely different nature and behavior of compost fertilizer in soil the same results can be obtained with low grade 1, 2, and 3% N as is the case with high grade, 6, 8, 12% N mineral concentrates.

PLANT SYMBIOSIS

ERICA SABARTH

The farmer and gardener who live intimately with the plant world and the flow of the seasons are the first to realize that a plant cannot be thought of as a single object separated from its surroundings. They know that in order to understand all the functions of life, growth, propagation and health of a plant it is necessary to take all the factors upon which its development depends into account. It really needs, and is influenced by, the whole earth, by the soil and its earthy substances and forces, by the surrounding atmosphere as well as by the sun radiating light and warmth and life forces.

The plant needs the soil for its support, it needs the soil moisture, and the nutrient salts dissolved in it for its nourishment. Both will influence the plant according to their quantity and quality. A moist soil, rich in humus, certainly helps a plant to develop more strongly and better than a poor, sandy and dry soil.

The growing plant needs the air around it. From the carbon dioxide and the moisture of the air the plant builds up, through its chlorophyll in the green leaves, its own substances. But this it can do only with the help of the sun. Only where there is light is the plant able to form chlorophyll and through it to synthesize its own building stones, the carbohydrates, starches, sugars. The different intensities of light, the quality of light, play a great role in plant variations. The amount of light and the amount of warmth influence the plant in its blossoming and the ripening of its fruits.

Even the stars, the planets have an influence, especially the moon, for instance, on the rising of the sap in the trees and on the germinating of the seeds.

Without all these influences from the mineral, terrestrial and from the cosmic world there would be no plant life. The strongest and best plants will develop where they receive all these influences in just that harmonious balance which is best for their particular kind.

But besides all these influences of the earthly and cosmic surroundings there are many other factors which play a role in the development of the single plant. There are the relationships between plant and animals, and there are also the more

or less apparent influences working between plant and plant, plant symbiosis.

Symbiosis means a living together of two different kinds or organisms in such a way that they act one upon the other, influence one another. It is a kind of partnership, just as—taken as a picture—in our human realm two business partners join together in order to derive mutual and even higher benefit from their association than they would gain alone. This is a purposely started and established partnership. But there are others too, coming about in a more subtle way, as when two scientists or two artists, or even better a scientist and an artist work together, each one on his own task. Just through discussions or mutual observations of the other's work, they stimulate each other in such a way that they more easily find the solution to their own problems and may solve them in an even more perfect way.

In the plant realm we also have these two different kinds of partnership, of symbiosis as it is called here.* With the business partners we could compare those plants which live together in close connection, growing one upon and with the other, providing each other with the plant food they need, giving each other that plant nutriment they can provide and the other is lacking, and so together building a strong plant association, while they might not be able to exist alone.

Then there is the other more subtle partnership, where each plant is perfectly able to take care of itself, to grow, to blossom, to bear fruit, but through the fact that a certain other plant is growing nearby, the first one is stimulated to an even better growth and fruit production.

All these influences so far mentioned are mutual good influences, they signify a helping of one by the other. But there may be an association—one could not rightly call it then a partnership—where one person tries to take all the benefit for himself, just thrives on the good will and work of his partner without contributing anything himself, and even endangering the life existence of the other. Now this we call in the human as well as in the plant world: a parasite.

A parasitic symbiosis in the plant world we find where we have to do with plants which are not able to synthesize their own food, to build up their own substance, and therefore try

* The term symbiosis is used here in a more general way than in the strictly botanical sense. Another term would be companion plants.

to gain it from another plant to which they attach themselves closely. They are already visibly indicated as parasites by their lack of plant green, of green color. The ability to synthesize their own plant substance in order to grow is dependent, as already mentioned, on the chlorophyll. Non-chlorophyll bearing plants like the fungi therefore have to take their plant food from another living organism.

A real parasite for instance is the cuscuta or dodder or clover silk, as it is also called, which can be very annoying for the farmer or gardener whenever it starts to spread, especially in a clover field. There is also a dodder growing on flax and one on alfalfa. They all have no chlorophyll bearing cells and therefore try to get their food from other plants by twining their long orange or red threads around the stems of the clover plant, and with a kind of sucker they penetrate into the stem, taking out all the nourishment they need, weakening and more or less suffocating and tearing to the ground the clover plant and thus eventually killing their host.

Many tropical plants like the orchids are often falsely taken for parasites, but their symbiosis with the trees is not a parasitic one. They use the trees on which they grow only as support. They are otherwise able to build their own food, having green leaves. But they need light in order to do so. And in order to get that light in the dense jungle forests they attach themselves to the tree branches. They really belong to the class of the epiphytes.

The classic examples of an intimate symbiosis for mutual benefit described in botanical textbooks where symbiosis is mentioned at all, are the lichens, which cling to old tree trunks or to stones. They are quite a large family, about 4,000 different species of lichens in a manifold variety of forms are known. They play quite a role in ecology since their secretions etch and dissolve the hard rock minerals and their dead remains slowly build up a humus substratum in which higher plants can gain a foothold. Well known is the reindeer lichen covering large stretches in the northern lands, especially Siberia and Lapland, where they are often the only food for the reindeer, hence their name. Now these lichens have the appearance of one single plant organism, but they are in reality a symbiosis of two different kinds of organisms. The one is a fungus, the other an alga from the species of the greenblue algae. As the name indicates already, these algae are chlorophyll bearing and there-

fore can assimilate their food from the air, can synthesize carbohydrates. The fungi which cannot do this, grow with their mycelia around these algae and take part of the food which the algae can provide. The fungus, on the other hand, provides the algae with moisture, water and the nutrient salts dissolved in it, shelters them against drying out and clings, with its mycelia, both to the bark or stone. So here we have a symbiosis with a mutual benefit to both sides.

There is another close partnership of mutual benefit which is certainly of much more interest and of great importance to the farmer or gardener, and that is the symbiosis between the legumes and the nitrogen-fixing bacteria in their root nodules. These bacteria, the so-called Rhizobium, live in the soil. They enter the legume plant from the soil through the hair roots. Once within the root, the bacteria induce growth of the root nodules. These nodules are at first white in color and need and at first take nitrogen from the host plant for their nourishment. In this time the bacteria multiply rapidly by simple division. They begin to change into bacteroids, and besides a reddish pigment appears which has been found to be a hemoglobin.*

In the last 12 years it has been observed and more and more confirmed that the nitrogen fixation in these root nodules is dependent on the appearance of the socalled legume hemoglobin or leghemoglobin as Prof. Virtanen of Helsinki, who has done much research work in this direction, calls it. His experiments showed that ineffective root nodules do not contain the leghemoglobin, and that on the other hand the amount of nitrogen formed is in direct proportion to the amount of the leghemoglobin. After the nodules have received enough nitrogen in the first days, retaining it as bacteria protein mostly, the important phase starts. In this phase, the time of the strongest growth of the legume plant and during its whole flowering period, the most nitrogen is fixed by the nodules, and they give 90% of this nitrogen to the host plant, keeping back in the nodules only about 10%. During this period the leghemoglobin slowly starts to change from red to green, at first in the nodules near the tip of the root, until they are finally all green. Then the nitrogen formation stops and a decomposing process quickly takes place in the nodules. The bacteroids are destroyed and the original rod-like bacteria appear again, continuing their life in the soil.

* Hemoglobin is the red pigment that gives our blood its color.

Here we have again a symbiosis, each helping the other while performing his own task. The legume plant gets its nitrogen from the bacteria in the nodules. But it also gives something in return to the bacteria, and that is the carbohydrates which it transforms from the air, light, warmth and water. The bacteria take in these carbohydrates which give them the energy to cause the atmospheric nitrogen to combine with hydrogen and oxygen, and then pass it on to the host plant. The more nodules a plant has, the healthier it can grow and the more protein it will contain in its seeds.

I might just mention the probably well known fact, that the presence of relatively high concentrations of fertilizers such as nitrate or ammonium compounds in the soil, inhibits nodule formation. Clover may even disappear entirely from fields fertilized with ammonium sulfate. The same effect will be seen from the application of fresh liquid cow manure with its free ammonium content.

A similar beneficial symbiosis we find in the forest in the so-called mycorrhiza on the roots of the trees. Mycorrhiza form caps of closely felted threads over the ends of the roots and aid them to absorb nourishment from the soil and make combined nitrogen available to the tree, according to some agriculturists.

Now there are plants which to judge by external appearance seem to be quite independent, for they possess large green leaves with which they are able to assimilate vigorously. In spite of this however these plants only develop normally when their root system is in direct connection with the roots of other plants by means of small disc-shaped organs, the socalled haustoria.

To this plant group belong:

cow wheat — melampyrum lineare
lousewort — pedicularis cannadensis
bastard toadflax — commandra umbellate
eyebright — euphresia

In all the symbioses so far mentioned, the different plants are living more or less in direct contact with one another, in a physical symbiosis. But there is the other and so much more important and more far reaching symbiosis in the whole household of nature. And this symbiosis one can call dynamic symbiosis, not depending on immediate touch or connection, but on influences being effective on the other plant even from a distance. These dynamic influences can partly be explained as being

brought about through root secretions, through leaf secretions or through aromatic substances exhaled by the plant. In part, the way the influence comes about is not readily visible to us, we only see and observe that there is an influence. Now, this kind of symbiosis one can find everywhere, observing wild nature in its plant associations, as well as studying garden and field, to see how the plants growing together in different combinations prosper or hinder each other in their development.

In a forest, for example, when we start to look for the young seedlings which are the assurance of the future life of the forest, where do they sprout up, where do they look healthy and strong? We will find that few seedlings will show up under a spruce tree. Whilst under a fir or oak tree whole batches of young spruces are growing nicely. There we see the importance of a mixed forest, or at least having in a spruce monoculture from time to time a few fir or oak trees or birches. In a mixed forest, because of its very nature there is a far greater stimulus to germination. Every plant or tree variety through the needles, leaves or twigs which it casts off, creates around itself a quite specific sort of humus. Leaves and needles are variously aromatic and also decompose differently. The spruce needles produce a very sour raw humus and therefore have a growth checking influence on all plants, especially on grasses which prefer a neutral soil. Also the leaves or needles of one variety growing by itself easily form on the soil a layer impermeable to the air, a kind of felt. In the case of the mixed forest, a loose, crumbly layering is the result. Mixed woods develop a richer and more permanent type of humus than does a monoculture forest. We can observe that oak grows poorly under oaks, beech poorly under beech, whilst all others thrive well under oak trees. The beech also. in a mixed forest, has a beneficial effect.

Spruce trees sprout best under birches and cedars.

The berries too have their preferences. So the blueberries definitely prefer the light border of a pine wood. Under oak trees they grow slowly and bear hardly any fruit.

Strawberries become more aromatic in taste when growing in the neighborhood of pine and fir trees. In the garden we can achieve a similar effect by mulching the strawberries with needles from these trees.

All the trees and shrubs of the legume family help other trees, and it is always good to have them around the edges of a

wood lot, like honey locust, Scotch broom (Cytisus scoparius), locust (Robinia pseudacacia). Black alder, through the action of its roots, helps drain wet soils and would be a great help near swampy woodland.

There is, by the way, a leguminous shrub, Acacia sphaerocephala, a native plant of Africa, which is a very interesting example of a symbiosis for mutual benefit between plant and animal, or insect. The thorns of this shrub are inflated at the base and in the hollow inflations there live colonies of very fierce ants which defend their homes energetically against other insects. In this way the tree is kept free of leaf eating insects, of borers and so on. Strangely enough the tree seems to reward this kind protection of its guests, for it produces from the edges of its leaves pellets of nitrogenous matter, the so-called Belt's bodies, which are eagerly gathered by the ants. Thus the ants receive food and a living place, while the plant is kept free from insects which might be harmful to it.

Professors Fahrenkamp and Molish found out through many experiments that digitalis, aconite and scilla have a significant growth stimulating effect on other plants and give especially an enduring quality to those which grow in their neighborhood. Digitalis likes the border of the forests and open places in the woods and one can assume that also there they take over a beneficial biological function and influence the growth and duration of the stand of trees. Research in this direction would certainly be very interesting and important.

Also in the fields and in the garden it is not a matter of indifference but of great importance in what associations the plants are growing. Thus the shallow rooting and the deep rooting plants supplement one another through the differentiation in their root systems. The legumes, for instance, promote root growth in their neighborhood not only through the nitrogen they give to the soil but also through the aeration of the soil resulting from their own deep growing roots.

In pastures, the deep rooters such as alfalfa will remain green longer and give protective shelter for the shallow rooting grasses, hinder evaporation and keep their companion plants alive for longer periods than they might otherwise last.

There are many beneficial or antagonistic symbioses between plants which are not so readily explained, but which can be observed and also proven by experiments, by growing the

plants in question together and observing again the resulting benefits or damages as to crop, growth and so on.

Rudolf Steiner has given quite a number of indications in this direction which have been used and proved in practice, especially as to border plants, and above all as to the plants used for the B.D. Preparations.

By border plants we mean using these plants by having them spaced about three feet or more apart around the border of the field, or at least on one or more sides. Esparsette planted in this way is of special benefit to grain fields. Also it is good to have an occasional yarrow plant near the field or garden, and a few camomile plants.

The camomile plant is especially interesting, as it shows a two sided effect in its influence on other plants. That is, it helps the other plant, when used in a dynamic way. That means, it is beneficial if there is only an occasional plant growing in the middle or at the border of the grain field, and then it stimulates the wheat to grow heavier and with fuller ears. If however it is planted or occurs naturally in thick patches in the field, or is planted in patches or rows in the garden, it will inhibit the growth of the neighboring plants and the result will be small and light seed only. In the herb garden camomile will lower the oil content of peppermint, if growing close to it in larger quantities. This information has all been checked with plot tests of varying combinations.

Beneficial to the grain fields is also the cornflower if not growing in over-abundance. But the red poppies growing among wheat, especially winter wheat, may look nice in a field, yet they definitely check the development of the grain plants and lower the yield of the wheat kernels, as every farmer knows. Wild larkspur also shows a liking for winter wheat. Both poppies and larkspur dislike barley. So they may lie quietly in the ground during a barley growth, but will awaken to full activity, when in the rotation of the crop the winter wheat reaches its turn. Also antagonistic to winter wheat are buckwheat and hemp.

Rye is considered a good weed fighter. It inhibits, among others, the germination and growth of the field poppy, and twice planted in succession it can even eliminate the troublesome quackgrass (triticum repens). The wild pansy on the contrary is very much benefited by the rye. Wild pansies usually germi-

nate only 20% to 30%, but if the seed gets into a rye field, it will have almost 100% germination.

Hedge and field mustard like oats. The mustard has an alkaline secretion around its roots and thus sweetens the soil. These two also inhibit the growth of the annoying rape and thus keep the oat fields free from it. Turnips are harmed by hedge mustard and by knotweed. In Europe there is a saying, that hedge mustard eats the turnip. The field mustard also hinders the growth of Atropa Belladonna and should be weeded out where the Atropa Belladonna is raised as a medicinal plant for the purpose of getting the Atropine. The field mustard itself is depressed by Symphytum (comfrey).

For the potato fields Dr. Steiner recommended especially as stimulating, to have a horseradish at the corner of the field, (which has to be taken out each year in fall, otherwise it will spread too far). The potato itself chokes out other root herbs, but the orach (Atriplex hortensis), a relative of the pigweed, likes to grow next to it and prospers well. If it starts to grow in abundance, this is a sign that the soil in the potato field is exhausted, just as soils tired out from consecutive plantings of hoed crops frequently show this through an increase of black nightshade. The farmer can learn much with regard to the immediate state of the soil by watching which weeds appear in a field.

In the garden, early potatoes do very well together with beans or peas.

Other more or less well known combinations of vegetables in the garden, which benefit both parties are: carrots and peas; red beets and kohlrabi; red beets and onions; cabbage and beans; leeks and celeriac. Beans planted together with leek and celeriac are alright, but if beans are planted too thickly between leeks and celeriac, all three become generally stunted. Cucumbers grow well together with, that is, alongside of or between, peas and bean rows, and also between sweet corn, which can be used as a border planting. Pumpkins also feel well, planted next to sweet corn. Carrots are helped not only by peas, but also by leaf lettuce.

An unfavorable association is tomato and kohlrabi; if planted together, the one planted last generally suffers and is hindered in its growth. The tomato is benefited by parsley, but it thoroughly dislikes fennel. Bush beans also have a dis-

like for fennel, and caraway does not feel happy at all in its vicinity.

In general aromatic herbs, except fennel, have a helping and stimulating influence on all vegetables, if grown as a border or at the end of a row.

Dill, rosemary, sage, vermouth all have a very beneficial influence, for instance on cabbage. Further, sage and mint repel the cabbage worm butterfly and thus protect and further all the more the good development of the cabbage heads. Cabbage and strawberries do not like to grow next to one another. In this case it is the strawberry that will be at a disadvantage.

A plant frequently considered a weed but with a very beneficial influence on many plants, is the stinging nettle, Urtica dioica. It makes the other plants more resistant, it changes the chemical processes in the neighboring crops and besides it stimulates humus formation, and also in this way helps its companion plants. Grown between tomatoes, it has the effect that the tomatoes keep longer, do not rot so easily. It does the same to the medicinal plants and herbs. Planted in rows between the herbs, it improves their aromatic quality and raises the content of the etheric oil, up to 4 times as much in camomile, and doubles the amount of etheric oil in peppermint. Furthermore the pressed juices of the plants growing alongside stinging nettle do not mold and putrefy so easily.

The peppermint growing together with camomile will be hindered in its oil production, whilst the camomile itself benefits from this symbiosis and will have a higher oil content.

As to the herbs among themselves, it has been further found out that rosemary and sage have a stimulating effect on one another. Rue and basil dislike each other. Coriander strengthens the seed formation of anise, while caraway hinders the seed formation of fennel.

Radishes planted together with chervil will be benefited in growth but also will have a very hot and sharp taste, while planted together with garden cress or leaf lettuce, they will have a delicate flavor and good quality.

A peculiar symbiosis is, that garlic grown near roses heightens the production of the aromatic substances in the rose.

As to aroma, Professors Madaus and Molish both found out through experiments and observations, that apples have the effect of fostering thickness of growth and hasten ripeness while limiting germination, and growth in length of peas, Lepidium,

lupine, rye. This was found to be the result of very small amounts of ethylene gas being given out through the cells of the skin of the apple. The blossoming dandelion also breathes out traces of ethylene gas.

The crowfoot or buttercup, on the other hand, has a general growth depressing influence on neighboring plants.

The so much scolded ragweed has been proved to stimulate the tobacco plant so that it grows faster, matures more quickly and has the desirable quality of tobacco grown on virgin soil. The tobacco plant is retarded in growth through Chenopodium album or lambs quarters.

In general not only herbs but summer flowering plants and shrubs, such as wild roses, elderberry, buddleia, bee balm and others, around a vegetable garden, always have a health improving influence on the vegetables.

To find out and to know more and more of such stimulating or antagonistic plant relations can be of great help to the farmer, and especially the gardener. He certainly will benefit from a good plant association as well as the farmer does from a good crop rotation. In reality these two overlap more or less, the one showing the influence in time—one crop after the other—the symbiosis showing the influence in space,—one plant next to the other, i.e. through juxtaposition or companion planting.

STRANGE NEW FOOD FOR ANIMALS

The results of research in this modern world of science are often exceedingly strange. The Wall Street Journal of October 9th reports on a new source for a high-protein supplement for livestock. Researchers at the University of California are working on a cheap method of sewage disposal which consists of holding the material in ponds where algae are raised. The algae produce oxygen which helps bacteria to breakdown the sewage. They thrive and grow mightily on the carbon dioxide which is released in the breakdown process. After the purified water is drained away the algae can be harvested and used as a rich cattle food. Calculations so far work out that 1000 pounds of algae can be produced from 1 million gallons of sewage.

MULCHING

EVELYN SPEIDEN

"What is mulch?" the new gardener is bound to ask sooner or later, unless he looks it up to avoid showing his ignorance. Even then he gets little help. The dictionary has not caught up with the modern idea of mulching. Webster says, "Any substance, as straw, used to protect roots of plants from heat, cold or drought, or to keep fruit clean." True as far is it goes, but no mention of soil. Mulching is whatever the gardener or orchardist (the farmer too, when he can) does in imitation of nature to preserve the humus content of soil by keeping it covered. This activity of mulching, brings benefit too, to plants, animals and man in so far as they all rely on the soil's health. The materials used as mulch are many and varied, some better than others, often hard to get in sufficient quantities.

Mulching, like composting, is an old practice, for those watching Nature with respect and affection have always been quick to see that she did not like her soil exposed. Direct sunlight and heat, drying wind, pelting rain, all these should be tempered before they touch the precious soil, filtered through mulch as they are through the foliage of plants. Where in nature do you see the naked soil? Only where man has worked. Even after a natural catastrophe, Nature produces weeds promptly to cover and heal her wounds. They are the plants that can adapt to one situation or another most readily. If you take note of those which are trying to protect your garden soil, they can tell you much about conditions there,—but that is another story. As growing weeds are natural mulch, so weeds that you take out may also be laid down for a mulch as you pull them, until you can get other material. They make a good emergency mulch, but use them before seeds are formed.

Traveling from Canada to Mexico one finds a great difference in the humus behavior in soils. In the cool north an application of good manure at the rate of ten tons per acre, ordinarily lasts four or five years. In the central states it is more likely to be three or four years. Farther south it becomes necessary to apply manure more often, possibly every two years and only five tons. Higher temperatures cause faster oxidation of humus. Cold and moisture tend to preserve humus; heat, strong light and drought tend to destroy it, especially on cultivated or open fields. This is why Nature grows jungles in the tropics. In

these hot regions, soil requires more protection to slow up oxidation as well as to protect from erosion by tropical hurricanes. Cleared land deteriorates fast there. It needs fallow periods to recuperate with a new jungle cover for several years, and jungle growth to provide green manure, new shelter for animals, etc. The jungle is one form of natural mulch.

The Bio-Dynamic ideal includes mulching, of course, done with special principles in mind. In all our Bio-Dynamic work we keep remembering that there are two great processes in nature,—the GROWTH PROCESS and the DECAY PROCESS; one upbuilding, one tearing down. Actually they cannot be separated for they blend and supplement each other constantly. Only in recent years has the decay process been getting the attention it deserves, for it is of equal importance. Without decay the world would soon be swamped with piled up dead material. Without decay the growth processes would have nothing on which to build. We spend much effort directing growth processes towards the exact results we want, but too often the decay processes are left to take care of themselves. An ideal garden is possible only if we control and direct the decay processes too. They must work towards humus, nothing else. Unfortunately there are many other directions they can take. The chemist says the end process of decay is carbon dioxide and water. This isn't much help to the gardener. Uncared for organic waste may give a raw or crude product with undesirable microorganisms and unstable chemical combinations that permit precious trace elements to wash away. Humus is stable and holds on to its valuable plant foods as well as extra reserves of water. To work with organic material is not enough. We must also *direct* the organic breakdown with as much care as we do the growth of higher plants. For what we think of as decay, is really teeming life of a lower order, millions of busy microbes in a mere thimbleful of soil. Nature deals always with life.

It is by means of the Bio-Dynamic Preparations 502 to 507 that we direct the decay of organic matter, whether it be in a compost pile, a manure pile, a disced-under green manure crop, or a mulch. For on the under side of a mulch where it touches the soil, decay is taking place, processes that may make or mar a crop. "I never seem to be able to get enough mulch," is the gardener's lament. Of course, because good mulch is transient. It disintegrates from below. You can't just cover your garden neatly with mulch and consider the job done. It must be added

to frequently from above. At least, this should be true. If your mulch does not disappear gradually, something is wrong under there.

To make sure this humus-forming process is functioning properly under a mulch, we need the influence of the Preparations 502 to 507 there. This may be accomplished in various ways. For the home gardener, the easiest way is to spread a Bio-Dynamically treated manure or compost pile on the loosened soil and rake it in lightly just before spreading a mulch. Thus the mulch protects the precious fertilizer you have spread, and the fertilizer works gradually and correctly on the mulch to add slowly to your soil humus.

In places like California where hundreds of acres of vegetables are raised with no chance to get manure or compost, the only possibility of adding to humus is with green manure. For such a situation, Dr. Pfeiffer developed his Starter Field Spray. This is spread from low-flying airplanes directly onto the green crop residues. Tractors wait at the edge of the field and follow the planes at once to disc in the sprayed plants. Mixed thus with soil, they decay and the field is ready for replanting in a fraction of the time it used to take.

For the home vegetable garden nothing is so good as barnyard manure, Bio-Dynamically treated while fresh and allowed to ripen with the Preparations 502 to 507. But sometimes this is hard to get and we may be thankful for substitutes. Also in orchards where manure is not so good, composting or an adaptation of it is preferable. Plow or dig around the trees (not too deeply) a little farther out than the branches reach. Spread a moderate amount of broken up mulch at once before the soil can dry. Then if the mulch is very dry you may need to wait for a rain. Spray the B.D. Compost Starter on the mulch, rake to mix mulch well with topsoil (and you can't ordinarily do this without having loosened your soil first), and add another layer of mulch as thick as you wish to protect the mixture. This is best done in late summer or early fall *after* the fruit harvest. If you have had the trees mulched all summer so that your soil is soft, and if you have facilities for discing or otherwise mixing mulch with topsoil, you can spray directly on your old mulch, mix and then add more. Three rules need to be kept in mind,—

1.—*Never work with bone dry materials.* Sprinkle or wait for rain. Microorganisms need moisture and may die off or change their character if deprived entirely of it.

2.—*Always mix organic matter with soil,* in applying any form of the Bio-Dynamic Preparations, and so that

3.—*Some air still has access to the mixture.*

Besides the Bio-Dynamic Preparations 502 to 507, there are also Bio-Dynamic Sprays 500, 501 and 508. (These are life-giving, not poison sprays and have been described in detail in Bio-Dynamics articles in Spring, Summer and Autumn issues of 1950, 25c each.) The only one of these directly connected with mulching is the 500, which is applied to the soil for the stimulation of root growth and seed germination. It is used only with or following the spreading of manure or compost containing the 502 to 507. That is, these preparations must work together. It is important to spray 500 also on soil before a mulch is laid down. For this too, the soil must be moist, never dry, and preferably loose and open. After applying the 500, rake it in lightly. It should be used at least once a year, and even better in both spring and fall when soil is most free of plant cover and yet not frozen.

When we have in one way or another mixed the loosened soil (plowed, harrowed, disced, spaded or otherwise tilled according to circumstances) with the Preparations 502 to 507 and the Spray 500, we may cover with mulch and forget it, *keep off of it,* until planting time. Bio-Dynamically our duty is done for the time being.

"What can I use for mulch?" is often a serious question, especially in a city garden. Rural areas probably abound in old hay or straw, and it is possible to get these fairly free of seeds. Use salt hay, young weeds, grass cuttings, tree leaves, almost any loose material that will not pack down so as to exclude air. Make no mistake, however, any mulch tends to create acid conditions. How serious this may be depends on various factors such as mulch material, thickness of mulch, kind of soil beneath it, etc. Bio-Dynamic treatment minimizes this, but wherever decay processes take place, acids are formed at certain stages. For this reason the Bio-Dynamic movement has always advocated confining these processes to the compost pile, not bringing organic fertilizer onto field or garden until it is already in the humus state. However, labor saving compromises are often necessary to accomplish what otherwise might not get done at all,—but we should remember that it *is* a compromise and not the ideal. Bio-Dynamically the best mulch would be half-decayed compost,—if one could ever get enough of it. Thus one

would get the effect of the Preparations well along in their activity, which will continue after the mulch is spread. Sad to say, this sort of mulch disappears more quickly than raw mulch by becoming part of the soil. Yet one gets all the advantages of mulch without many of its liabilities. A thin layer of half decayed compost with a thin layer of other mulch on top of it is good too, for thus the precious compost is protected. Some of the most acid forming materials are sawdust, wood chips, evergreen needles and especially peat moss. These should be used only on plants such as azaleas, rhododendrons, blueberries. etc. that like acid conditions. Strawberries like evergreen needles especially if partly decayed first with other fine material like chicken manure, grass cuttings, leaves, etc. Being easy to get, peat moss is often used, but unfortunately is the least desirable mulch. True it is plant material that is already partially decayed, *but* here's the hitch. Instead of being on its way towards humus, it has gone in the opposite direction towards mineral or coal formation by anaerobic (without air) processes that have taken place under water. As far as microlife is concerned, it has kinds we want to avoid in gardens. So if peat moss must be used there, mix it first with other materials in a compost pile, sprinkling lightly with quick or hydrated lime (not agricultural or ground limestone), and let it stand awhile. For acid-loving plants, omit the lime, of course.

Thick mulch or thin mulch? Again it depends on material and especially on kind of soil. When you hear miraculous claims for mulch don't jump to the conclusion that you can do it too. Perhaps you can, but make sure you have all the facts and that your soil is similar. Wonderful things are done with mulch and we have scarcely begun to explore them, but we must know underlying reasons to get best results with our own individual conditions. One special value of mulch is to help conserve soil moisture. A heavy clay soil absorbs moisture slowly but holds it longer than one that is quite sandy. The qualities of clay that make it suitable for modelling are the ones which make it difficult for gardens,—if handled when wet. With much water in clay soil after spring thaws, for example, we can do nothing but wait for it to dry out. With a heavy mulch it will keep us waiting much longer, perhaps even so long that we save ourselves the trouble of planting the garden at all. If we get impatient and work, or walk on such soil too soon, it becomes so full of clods that it is ruined for the whole season.

Nothing short of a winter's frequent freezing and thawing will put it in good physical shape again. Most gardeners have to experience this once to know what a serious problem clay soil can be if wrongly handled. Here mulch may be a liability instead of an asset. A thin mulch is often safer with a reserve to add as the season gets warmer and drier. Over winter use it thin too, for clay soil needs the sudden freezes and thaws of cold weather. A thick mulch would interfere with this. There may, of course, be times when the primary need is to protect plants from these frequent variations of temperature which cause the heaving of roots. Then wait until the first good freeze to lay your mulch. The freezing and thawing under a heavy mulch will be gradual instead of sudden and this is easier for some plants to bear. Also if you wait for real cold weather for your heavy mulch, mice and other little creatures will already have found their winter quarters and be less likely to settle where they can nibble at your plant stems.

Never lay *any* mulch close around tree trunks. It would encourage both animals and fungus diseases. For a heavy soil then, it boils down to this,—as a general rule use lighter mulches for fall, winter and spring; thicker ones in summer. One disadvantage of clay soil is its tendency to pack and exclude air, to cake and crack on the surface after a pounding rain followed by drying wind and sun. A light mulch will help avoid this and so obviate the need for cultivation to break the crust.

Sandy soil presents quite a different situation. Little danger of puddling exists. There the need is to preserve the moisture of spring on into the summer. Winter weathering is less essential to physical structure. One may safely use heavier mulches at any season. Plenty of cover helps too, in tempering the too quick response of the soil to temperature changes, which is hard on some plants. Sandy soils are usually more easily managed than heavier soils. On the other hand, they do not preserve their humus as well so need more frequent renewal. The continual decay of a generous mulch aids in supplying this renewal as well as in conserving it.

Between these extremes of heavy clay and light sandy soils, lie all sorts of intermediate variations, where only experience and careful observation of individual conditions can lead to the best practices. The Bio-Dynamic method helps "normalize" any situation, accentuating the benefits of mulch and minimizing its dangers. Often some ordinary garden practice which

works well one year, may bring only trouble another. In gardening one never gets all the answers. It is such fun because it keeps us learning. About mulch we still have much to learn but there is no doubt about its being an essential garden practice. Used wisely, "Mulch is magic for gardens."

Shall we summarize the assets and liabilities for mulching?

AS TO HUMAN LABOR

Saves most weeding—if thick enough.

Makes needed weeding easier—roots come out of soft soil easily.

Chokes out growth in unused areas—if very heavy.

Keeps permanent paths clean—if thick enough.

Saves cultivation by keeping surface soft—*if* not walked on while wet (especially heavy soil).

Only occasional tilling needed—to admit water to heavy soil for winter freezing; in applying Bio-Dynamic Preparations.

Occasional adapting of mulch—to seasonal and moisture changes.

Adds much work if stone is used—before Bio-Dynamic practices are established, before garden plan is tried and settled.

AS TO PHYSICAL AND LIFE FACTORS OF SOIL.

Shades soil and sensitive-to-light organisms—less important in winter with heavy soil.

Conserves soil moisture—if thick enough in summer; if paths and edges are thickly covered too; not desirable in wet springs on clay soil.

Slows down temperature changes in soil—especially sandy soils; undesirable in winter on clay soils.

During floods avoids erosion—prevents pounding of raindrops directly on soil; especially if land slopes.

During drought conserves moisture—on clay soil prevents cracking and caking; if mulch is thick enough.

During fog, mist and long wet spells—*dangerous!* Encourages mold, mildew and other fungus diseases (use Bio-Dynamic Spray 508).

Prevents leaching of valuable elements—by erosion, humus and acid control.

Conserves colloidal quality of soil—by coolness and darkness if soil does not become too acid.

Tends to make soil acid—during wet weather with too much mulch; especially with certain kinds of mulch; minimized by Bio-Dynamic Preparations.

Encourages earthworms—gives them added food and shelter.

Encourages beneficial microbes—if soil does not become too acid.

Prevents packing of soil to exclusion of air—if not walked on, use permanent path and beds that can be worked from paths.

Conserves humus—if thick enough in hot weather, if not too acid.

AS TO PLANT LIFE

Encourages root growth—demonstrate by mulching well on one side of a soy bean row and not on the other.

Aids seed germination—by keeping soil surface soft.

Contributes generally, and in more ways than we can mention here, to health of plants—if soil is healthy.

MR. EDDY'S LATEST GARDEN

Charles W. Eddy, good friend of Bio-Dynamics and of everybody in the B.D. Movement, has "done it again." Those who were at last Summer's conference at Spring Valley will recall his telling of current results in his back yard garden at Providence, R. I. Unable, for various reasons, to get up to his mountain farm this year, he had concentrated on seeing what he could do growing vegetables and herbs in hitherto neglected soil behind his city home. And the results, using mulching, very close planting and a thorough B.D. treatment, were more than just *good*. He had pictures to prove it, if his descriptions sounded too good to anybody.

Well, on September 13th the *Providence Sunday Journal* devoted a page, also with pictures, to Mr. Eddy and his garden. In the interview with the reporter he had stressed that Bio-Dynamic Gardening was the secret of his successful results. He and Mrs. Eddy sent us a copy of the clipping, and also sent one to Evelyn Speiden, our good Association secretary-treasurer, general garden and farm adviser to all inquirers, maker of the B.D. preps and patient friend to everybody. And the editors of Bio-Dynamics hear from her that she got a whole lot more than just the clipping. In the first week nearly 100 inquiries came to Chester as a direct result of the newspaper chronicle of Mr. Eddy's doings; and there have been a lot more since. More power to Charles Eddy, not forgetting Mrs. Eddy; and Evelyn Speiden, delighted as she is, would probably be grateful if somebody (Mr. Eddy perhaps?) could find some way of growing a few more hours into the space of a working day.

FOREST SEED PRODUCTION IN RELATION TO PLANETARY CYCLES—Conclusion.

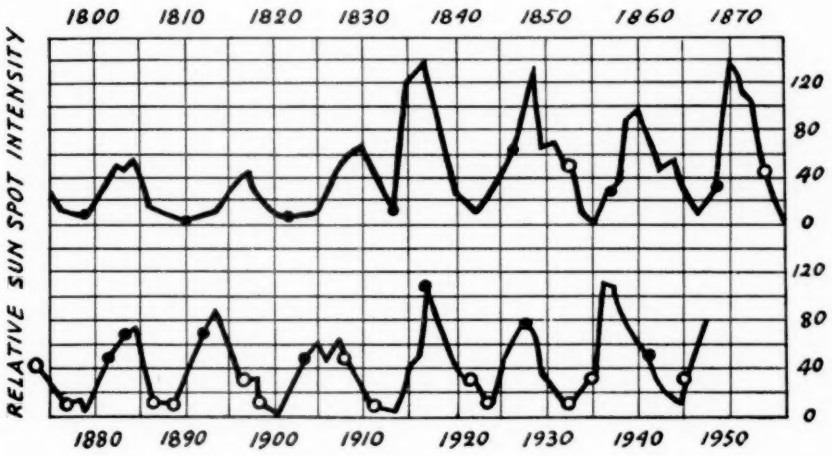
JOACHIM SCHULTZ

After the first section of this article, translated from a paper originally published abroad by Mr. Schultz, had gone to press, word was received here of the sudden and untimely death of the author at his home at Dornach, Switzerland. The editors of Bio-Dynamics join with all those who knew Joachim Schultz and his work, in regretting the loss of a friend. Science has lost the services of a true investigator and scholar.

The approximate 11 year cycle of sun activity and its most pronounced expression, the sun spot periods, have been studied for quite a long while and they have been considered and investigated from the most varied directions as being an important meteorologic and biologically effective factor. A problem often mentioned and treated in this connection is the question of the relation between the periodically fluctuating width of the growth rings of trees and the sun spots. The American scientist A. E. Douglass has carried out comprehensive studies of the rhythmic variations in the annual rings in the case of 57 groups of American and North European trees, with particular stress on those of the California Sequoia gigantea. The periodic fluctuations in growth, determined by him, point on the average to 11 year rhythms which partially coincide with the curves of the sun spots. Thus the widest rings coincide with the maximum sun spots, when at the same time heavier average rainfalls are recorded; while the least growth expressed in the narrowest annual rings falls in the dry years with a minimum of sun spots. Despite this close coincidence between growth rhythm and sun activity, arrived at by calculating averages, the results given by Douglass should be accepted with greater caution than is usually the case. Further observations made since in other countries and by other investigators such as E. Anthevs in Sweden (1925), H. Knuchel in Switzerland (1933), and J. Hustich in Finland (1941), have led to results that deviate altogether at times from those set down by Douglass and even contradict his statements. At any rate, this all shows that the conditions here are more complicated than originally surmised.

Then too, especially in the case of Sequoia gigantea, the existence of other periodicities than those of 11 years has been established, rhythms which seem to bear no relationship to those of the sun.

Since the 11 year sun period seems all the same to approach the above discovered fundamental rhythm of the seed years, it seems proper to compare the two rhythms to look for a possible connnection between them. The result can be read from the following diagram.



Seed Years of the Red Beech and Sun Spot Periods 1795-1946
(Relative Figures on Sun Spots by Wolf)

• Seed Years Series I • Seed Years Series II

The seed years listed in Series I from 1800 to 1850 fall so close to the sun spot minima that one might readily be tempted to presume, on surveying these 50 years alone, that there is a definite, close connection with the sun spots. However, in the course of the second half of the 19th Century it becomes ever more apparent that there is a constant shifting towards the course of the sun spots, which leads to the seed years of Series I coinciding closely with the sun spot maxima from 1892 to 1928. It is only in 1941 that for the first time a distinct overstepping of the maximum position is noted.

In a similar way, a continuously progressive shifting toward the sun spot curve in the seed years of Series II can also be traced.

From this it is clearly evident that the two rhythms do not run the same course. Besides, it seems important to learn from this example that observations covering only a few decades are not sufficient to definitely establish the existence of a rhythm which directly parallels that of the 11 year sun cycle.

In conclusion we shall now turn to a study of the years preceding the seed years of the beech as regards the positions of the planets *Mars* and *Venus*. Mercury does not come into question here because of its rapid changes of position. Characteristically preferred positions of both Mars and Venus also appear.

Figures 3 and 4 present a comprehensive view of the positions of *Mars*. In contrast to Saturn and Jupiter, more than a single diagram is necessary in order to properly judge the significance of Mars movements. Thus Figures 3a and 3b show the different positions of Mars at two different sampling periods, the beginning of May and the middle of July, of the years preceding the mast years. For purposes of comparison, Figures 4a and 4b present the Mars positions of the same periods during the *seed years* proper. Placing them thus, in opposition, brings out more strongly the intense concentration which appears in the upper or summer half of the Zodiac during the decisive years which precede the seed years for the Mars position. In the beginning of May, in these preceding years, when the beech starts growth we also find again for Mars a marked grouping of its positions in the first quarter of the Zodiac, as was the case with Jupiter. However, this concentration of positions is not a momentary one, but something that moves along parallel to the seasonal Sun course in the upper half of the Zodiac. The periods when Mars in this way wanders through the Zodiac for months at a time in the neighborhood of the Sun also contain an astronomical expression of their relationship, the conjunction of Mars and Sun. The diagrams, 3a and 3b, therefore, also point to the fact that Mars positions near conjunction with the Sun appear to be preferred. Besides, as Mars during these periods appears to us behind the Sun and in its positions farthest from the earth, so in the summer months of the years preceding the seed years, its positions distant from the earth are also marked.

The following table presents the above described conditions in figures:

Mars Positions in the beginning of May during	28 Pre-Seed Years	28 Seed Years
Distant from the Earth (Near the Sun)	17 times—61%	3 times—10.5%
Intermediatte Position between Far and Near to Earth	8 times—28.5%	10 times—36%
Near the Earth (Opposition to the Sun)	3 times—10.5%	15 times—53.5%
In Upper Half of Zodiac	22 times—79%	15 times–53.5%
In Lower Half of Zodiac	6 times—21%	13 times—46.4%

The average of the 150 years from 1801 to 1950 gives the following percentages for the Mars positions at the beginning of May:

67.5% in the upper half of the Zodiac.
32.5% in the lower half of the Zodiac.

Finally, in order to illustrate the peculiarities of the Venus positions a somewhat different way of presentation has been chosen in Figure 5.

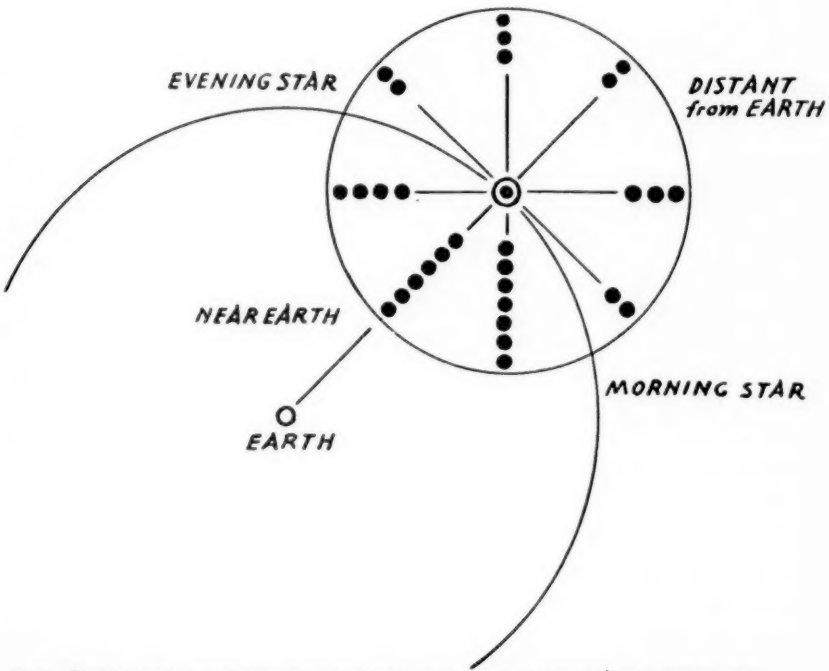


FIG. 5. VENUS POSITIONS (BEGINNING of MAY) IN THE 28 PRE-SEED YEARS of THE BEECH from 1799-1945

The appearance of Venus depends on an eight year cycle. Thus there result 8 quite distinct and characteristically differentiated years for the geocentric course of Venus and consequently only 8 typically differentiated possibilities for the sampling periods and the years under consideration. On the whole these possibilities differ from each other in that Venus is either spatially before the Sun, i.e. near the earth, or behind the Sun, distant from the earth, and further whether it is collaterally in a morning or evening star phase.

In Figure 5 the cases to be considered are indicated by the radii going out from the Sun. Now, if the seed years were to appear to be unaffected by the eight year Venus period, then a regular or strongly diffused distribution would be expected over all the years graphically shown in the 8 radii. However, it is noted of the years preceding the seed years that in regard to the Venus course, in those years when the Venus positions near the earth predominate in the six months of summer a distinct relationship is evident. A onesided preference for the evening or morning star phase has not been ascertained.

In summing up it can be said that the distribution of the seed years of the red beech, over the 145 years from 1801 to 1946, aside from local and seasonal weather influences, points to a relationship to the planetary rhythms, especially of Jupiter, Mars and Venus. A determinative main rhythm parallels the twelve year cycle of Jupiter. And regularly with the return of its periods of ascendency and also usually when passing through its periods of descent the individual preparatory seed years fall due. The fluctuations between the single intervals appear to be conditioned by the years where definite positions of Mars and Venus are present simultaneously in the summer six months. In the case of Mars, the positions in the neighborhood of conjunction and at the same time distant from the earth, and in the case of Venus the positions near the earth, seem to be favorable factors for the appearance of seed years.

To judge from the course of these rhythms the greatest beech tree masts, within the next few years, can be expected in 1948. A widespread beech full mast should begin again with the next period of Jupiter's ascendence, either in 1951/52 or in 1953/54.

The *Sternkalender** of 1948 contains an exhaustive investigation of the rich seed years of the red beech which shows a connection between the seed years of the forest trees and the

planetary periods. The drawing below is intended as a continuation of this research and helps to complete and expand it. The article referred to covered the 145 year period from 1800 to 1945. It demonstrated that when rich beechnut harvests occurred simultaneously over wide areas of Middle Europe, a fundamental rhythm always appeared that paralleled the geocentric course of Jupiter.

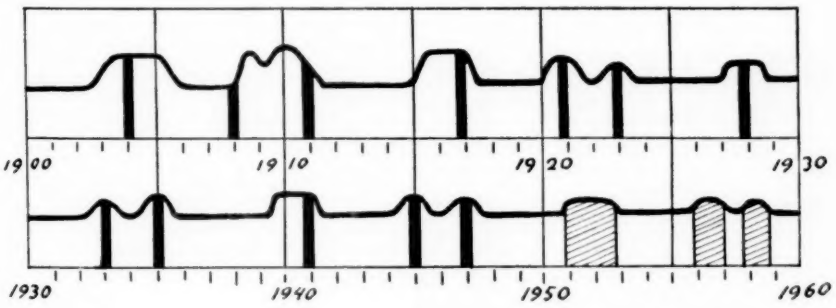


Fig. 1. The Universal Seed Years of the Red Beech and their Relation to the Jupiter Rhythm. (The black vertical columns indicate the years just preceding the seed year.)

Figure 1 illustrates this empirically discovered relationship during the last 50 years from 1900 to 1950. The vertical columns designate those years that precede the full mast beech years, for during the summer of these preceding years, the fruit buds start to form which forecast a full harvest in the ensuing year. The periodically waved line above the columns corresponds to Jupiter's twelve year transit through the Zodiac. This century and a half survey has shown that as a rule 2 to 3 rich beech seed harvests or years occur in every Jupiter period. At the same time, a distinct rhythmically recurring order appears following definite Jupiter positions, i.e. its rising and setting movements near the spring and autumn points of the ecliptic. The heaviest seed years reappeared with special regularity at intervals of 11 to 13 years in connection with the rising movement of Jupiter through the constellations of Pisces,

* Published by the Mathematisch-Astronomische Sektion, Goetheanum, Dornach, Switzerland.

Aries and Taurus (within the ecliptical lengths of about 0 to 75 degrees.) The one-pointed maxima indicate this in the curved line.

A second pronounced accumulation of seed years occurs in the setting positions of Jupiter on the opposite side of the Zodiac in the constellations Leo, Virgo, and Libra (within the ecliptical lengths of about 120 to 210 degrees.) In this region there often occurs a repetition of the seed years at 2 year intervals; this is indicated in the diagram with a two-pointed maximum.

In Figure 1, this curved line is extrapolated and continued parallel to the Jupiter course for the ten years from 1950 to 1960. As in 1951 Jupiter traverses the spring point in a rising movement, the course of the curved line would indicate that, in general, a rich beech seed harvest was to be expected in the next year or so, 1952 or 1953. When considering the rhythms of the planets Mars and Venus with their secondary effects, the astronomical aspect leads to the belief that pre-conditions should develop in 1951 which are favorable biologically as well as meteorologically and so would make 1952 a general seed year. Later seed preparatory years would not then be due again until somewhere between 1956 and 1958.

The relationships between the periodicity of rich beech harvests and the Jupiter rhythm, as established for the period from 1800 to 1950, has also been confirmed for an earlier period by the far reaching data contained in an old Forest Chronicle of the 16th and 17th century. These covered long periods of time and recorded the beech harvests in the Forest of Buedingen near Gelnhausen on the Vogelsberg from 1490 to 1730. As is known the years with rich seed crops had a certain economic importance at that time and were called "mast" years because of the herds of swine which were driven to such forests to fatten on the beechnuts and acorns. The size of the herds depended on the size of the seed crops. The forest records of Buedingen, as regards the size of the herds, fluctuate from a few hundred up to several thousand (6000 head in one case). This clearly demonstrates that the years vary and can be designated according to the harvests as rich, slight, or poor. Of course, the value of these records for our problem is, for various reasons, only brought out by summarizing and grouping the material. This is also necessitated because there are often gaps in the reports of one or more years. During the Thirty Years War, for instance, almost nothing was recorded between 1630 and 1650.

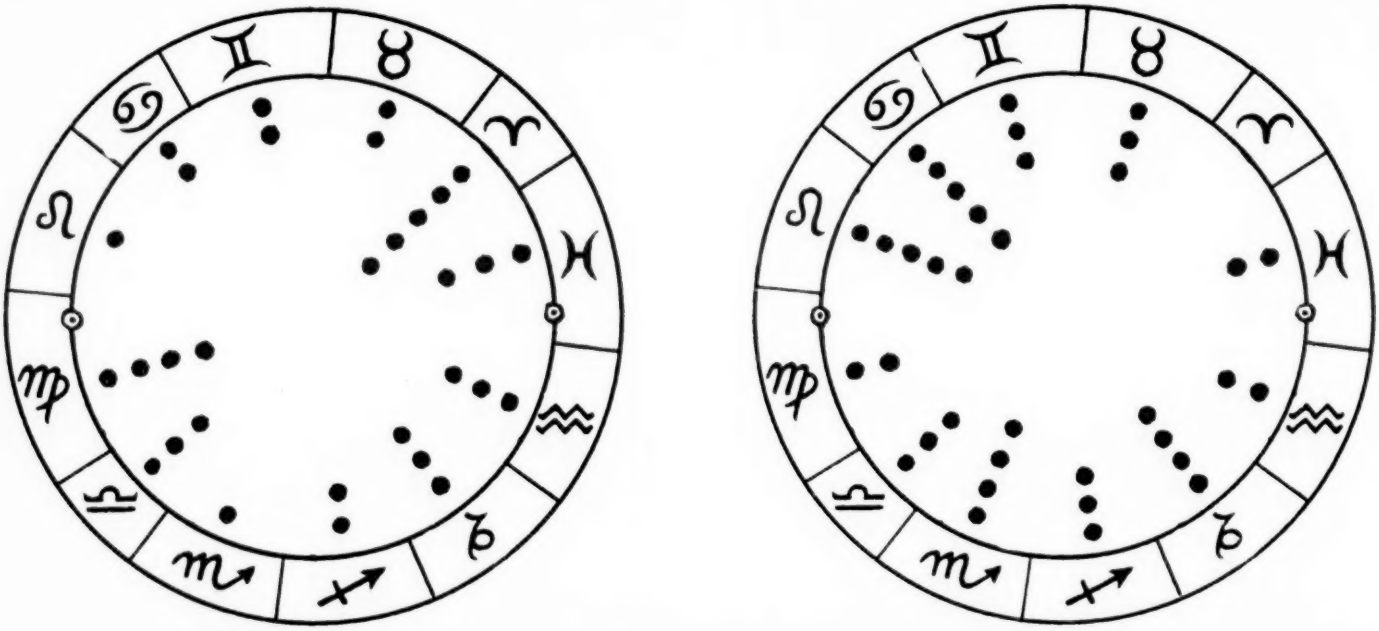


FIG. 2. DISTRIBUTION OF THE POSITIONS OF JUPITER IN THE YEARS OF RICHER AND POORER HARVESTS IN BUEDINGEN FOREST DURING A 140 YEAR PERIOD IN THE 16TH AND 17TH CENTURIES. LEFT: JUPITER POSITIONS IN PRE-YEARS OF GOOD HARVESTS. RIGHT: POSITIONS IN PRE-YEARS OF POOR HARVESTS.

The diagram in Figure 2 is based on the Buedingen Forest data from 1570 to 1630 and again from 1650 to 1730. In this 140 year period mention is made of 31 decidedly *good* and of 36 limited or *poor* seed years.

Good seed years in the Buedingen Forest region were: 1573 75 78 79 81 83 85 87 91 98 1600 03 06 15 30 50 56 65 67 69 74 76 77 78 79 80 98 1702 05 20 and 1727.

Poor seed years were: 1574 82 94 99 1602 05 12 13 14 16 18 19 20 24 25 26 27 29 1671 72 75 81 85 87 94 99 1701 07 08 12 13 14 15 18 23 25 and 1729.

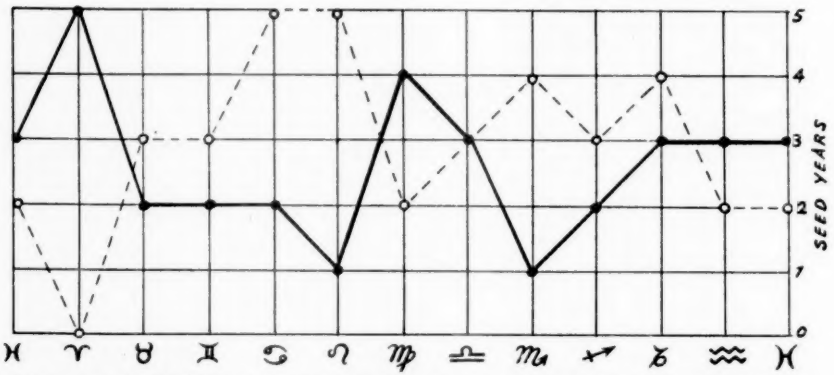


FIG. 3. THE CONTRASTING DISTRIBUTION OF THE JUPITER POSITIONS IN THE GOOD (—) AND IN THE POOR (---) SEED YEARS IN BUEDINGEN FOREST.

In order to find out whether these years, i.e. the years preceding them, parallel the Jupiter rhythm, the Jupiter position in the Zodiac was determined for each one of the latter. Figures 2 and 3 picture how the two year groups appear in relation to the appropriate Jupiter position. Despite the fact that the dots are rather scattered, there is a distinct appearance in the *good* seed years of the maxima groupings, as already described earlier, of Jupiter positions in the constellations of Pisces-Aries and Virgo-Libra. Inversely, it is just these spots in the opposite picture of the *poor* seed years, that appear as gaps, i.e. as sections where, as a rule, there were fewer deficient seed harvests. Thus both these diagrams, obtained independently of each other, complete and confirm one another in a meaningful way and so strengthen the certitude that the demonstrated Jupiter rhythm in the recurrence of the beech seed years is a reality.

HOW MOIST IS MOIST?

EHRENFRIED E. PFEIFFER

In instructions for composting as well as in recommendations for soil management, ploughing and cultivation, the terms, proper moisture, moist but not wet are frequently encountered. The question is asked what is "proper" moisture and how can I recognize it? Occasionally one gets a letter telling how the writer made compost from straw, dry weeds and/or corn cobs and poured water over the pile so "that it ran off." The sample accompanying the letter was analyzed in our laboratory and the writer was told the compost was too dry. In this case the water had run off indeed but had not penetrated, was not absorbed, moistened only the surface but had not entered the core of the particles.

Another question is when is the right time to plough a soil with regard to its moisture content. This problem is especially important for clay, loam and adobe soils since these soils are very sensitive to mechanical treatment. If they are too dry they cannot be handled. If they are too wet they cannot and should not be handled. If they are a little too wet they will compact, cake afterwards and get lumpy if ploughed.

Now we were asked could you not tell us in figures what is moist and what is wet? Is a moisture content of 55%, say, the borderline? The only answer to this is that each material behaves differently and that one cannot generalize. In one case 50% may still be rather dry and in another may be soaking wet.

Plants, for instance, contain 80% moisture or more and are still not dripping. The same is true of the human body, even the "dry" bones still contain a certain amount of moisture.

Our laboratory has set up a little demonstration of the different degrees of moisture. At our conferences and demonstrations we let visitors see and feel these samples of different materials. Anyone who is interested in the problem can arrange a little test for himself. It is with this purpose in mind that we have worked out the data on a few materials in the following table.

MATERIAL	% MOISTURE	APPEARANCE, STRUCTURE, COLOR
Virgin Soil from Missouri	8	dusty, grey
	20	slightly crumbly, slightly moist, dark grey

with high humus content not touched by man 6% organic matter	30	perfect structure and moisture conditions, black, typical humus look, crumbly
	40	begins to lump, black, moist, begins to get sticky
	45	standing, glistening moisture shows up. Wet.

The ideal moisture content here is between 30 and 35% and 45% is the borderline of absorption.

Adobe Soil from California 3.5% organic matter	10	dusty and hard, caked lumps, whitish grey
	20	loose, crumbling, moist to touch, dark grey to grey-brown color
	30	sticky wet
	40	muddy, water standing, and glossy surface.

The borderline for working this soil is near 25%.

Sandy Humus Soil from Arkansas 5.5% organic matter	2	dry, dusty, grey-brown
	10	loose, moist to touch, dark grey-brown
	20	becomes sticky, clay fraction gets lump, wet
	30	soaking wet, sticky.

The borderline is near 25%.

Chester, N. Y. Clay-Loam medium heavy B.D. treated 4.7% organic matter	8	dry, not dusty, crumbling, light brown
	20	loose, crumbly, moist to touch, brown
	30	still crumbly, moist, dark brown
	40	slightly muddy, wet, glossy surface.

Borderline 35%.

Organic materials such as peat, manure, and compost are quite different in their moisture behavior.

Peat 73% organic matter	10	dusty, dry, grey
	20	dusty, dry, grey
	40	slightly moist to touch
	50	slightly moist, changing color from grey to brown
	60	moist, granular like coffee grounds, changing color to black-brown
	70	crumbling, spongy-moist, black
	80	wet, water standing on top.

Borderline of absorption 75%.

Fresh Cow Manure no litter	40	slightly moist, yellow brown, spongy to touch
	50	moist, spongy, lumpy, dark brown
	60	moist, clumpy, dark brown on side exposed to air, green-brown inside
	70	moist to wet, green-brown
	80	wet, sticky green, lumps
	90	real wet, moisture visible, water oozes out.

Borderline 75%.

Starter treated Cow Manure well fermented	20	dry, yellow-brown to brown, particles fall apart easily
	40	moist to touch, dark brown, particles hold together
	60	moist to touch, dark brown, particles begin to stick together
	70	moist, but still absorbs moisture, black brown
	80	moist to wet, moisture shows and can be squeezed out.

Borderline of absorption 85%.

Half-rotted Compost from garbage 50% vegetable wastes 35% soil 15% manure	30	moist to touch, lumps, dark brown
	40	moist, but still absorbing water, lumps, black-brown
	50	wet, glossy, water shows and can be squeezed out, green brown.

Borderline of absorption 45%.

Well-rotted Compost Same Mixture	10	dry, dusty, powdery, grey-brown
	20	still dry, powdery
	30	moist to touch, crumbly, dark brown
	40	moist, crumbly, black brown
	50	wet, moisture shows, water can be squeezed out.

Borderline of absorption 45%.

As can be seen from these examples, an increase of moisture darkens the color but the borderline of absorption is quite different, so that the color alone does not give the exact amount of moisture unless one is familiar with the specific properties of the material. In general it can be said that the amount of organic matter increases the absorption and raises the saturation level in soils and composts, provided the organic matter is digested and transformed into humus. In fact, the degree of humus formation can be judged from the absorption factor. Peat behaves entirely differently from all other materials.

In a compost mixture the absorption will increase with fermentation. Very well-rotted composts with a high percentage of organic matter, containing less than 25% soil (not a "dead" soil) can absorb as much as their own weight in water, i.e. a ton of such compost will absorb as much as 250 gallons of water as we have seen in our experiments. Soils low in organic matter usually absorb but very little moisture and dry out quickly, sandy soils especially, while clay and loam soils hold somewhat more moisture.

Every farmer and gardener can make similar demonstrations of his own soils and compost on his own place without the help of a costly laboratory. While these home and field tests

will not give exact quantitative figures they will allow a certain qualitative evaluation. In this case, where no moisture determining apparatus is on hand one can proceed as follows.

Take a measured sample of your soil or compost, 4 ounces or better (for easier calculation 100 grams equal 3.6 ounces. You can weigh it on a postal scale. Take the sample as is, but describe its appearance, structure, color. Spread it on a dish or plate in a thin layer and let it air dry (a damp day with high air moisture is not suitable) or place it in your kitchen oven at 220 degrees F for one or two hours. Weigh it again and see how much weight equals moisture it has lost. Put the dry sample in a small cup. Use a graduated measuring cup or cylinder and add water until the sample is real moist, gets a glossy surface and does not absorb any more. Add the water slowly. Weigh the wet sample and see how much the increase is, in ounces, grams or cubic centimeters of water. Or read on the graduated cup or measuring cylinder how much water the sample has absorbed. Compare different samples of different soils and composts. The higher the absorption the better the organic status of your sample. After you have made a dozen or more of these simple tests you will develop quite a good amount of knowledge with which to answer the question: How wet is wet?

NEW SKIN TREATMENT FOR COWS

According to a report in the Sunday Herald Tribune of October 11th, the long-suffering cow is to receive certain and long lasting relief from flies and mosquitoes by means of a new under the skin application of insecticides. So far, lindane is the chemical poison which has been injected under the skin of cows by scientists of the Agricultural Department. The chemical is carried to all parts of the cow's body and when the bloodthirsty insects bite they pronounce their prompt death sentence. Wonder how the lindane affects bossy in the long run? We may never know.

CHINESE AGRICULTURE

M. HOLMES

Maybel Holmes, Ph.D., was born in China, of missionary parents, and lived in that country as a child. She was educated in the United States and taught school here. After serving in the China field herself, she earned her doctorate in connection with nutritional studies at Cornell University in 1949. She then went back again to China, and saw the country engulfed by Communism. She was able to get out, and carry on work in Malaya, from where she returned home to Alfred, N. Y., a little over a year ago.
The following is the text of the interesting lecture Miss Holmes gave at the B.D. Conference at Spring Valley last Summer.

Fertility and Conservation of the Soil of China

If one were to take an airplane trip over China he would see it green and fertile to the south of the Yangtze Valley, where it is most fertile of all, brown and fertile to the north, arid and desert-like in the northwest, high and arid to the southwest.

In China it is estimated that about 1/6 of an acre feeds one mouth. Many of the rice fields are tiny, some no larger than a bedspread on the terraced hillsides. A large granite rock may be in the middle of such a field around which the farmer plants and works. The average farm is three or four acres. For the average family, a farm is 1½ acres. Seventy acres is about as large a farm as anyone ever owns in China.

Conservation of the Soil

"Farmers for forty centuries, the Chinese have learned not to let anything go to waste. The appalling losses sustained by our methods of garbage disposal alone through incineration and pouring into rivers, lakes and sea is inconceivable to the Chinese. And to them would mean race suicide. Wanton waste is the keynote of our methods and when its withering blight shall finally threaten to engulf our civilization, we may yet be glad to emulate the Far East for our solution."

(From Cressy's **Asia's Lands and People**, McGraw-Hill Co., Inc. N. Y. and London 1944 P 41)

"Agricultural experts from the Occident have more than once remarked the skill of the Chinese farmer in taking advantage of the materials at his hand. Even to the amateur observer the application of practical agricultural lore is apparent. The most obvious testimony to it is the huge population which China

has been made to support, a considerable minority of it in comparative comfort...Modern scientific research in agriculture has much to contribute, and if its results are utilized, marked improvement will undoubtedly be registered. Yet after all the qualifying deficiencies have been taken into account, the fact remains that the traditional Chinese agriculture has much to commend it."

(From Latourette's **The Chinese, Their History and Culture**, 3rd Ed. rev. 2 vols in one. New York, The MacMillan Co. 1946 P 564)

Fertilizer

Human excreta or night soil is the main fertilizer used in China. As one approaches cities he sees the gardens and fields much greener and more luxuriant than in the country. At the time I was writing my thesis, 1947 and 1948, my professor discussed with me the possibility of finding some chemical which could be mixed with night soil to render it harmless to human beings. I am so gratified that Dr. Pfeiffer has found such a solution in introducing his bacterial strains into night soil to make useful and safe humus out of it.

Other forms of fertilizer are also used by the Chinese. Chaff, straw and garbage are burned and put on newly planted seeds. Very little composting of garbage seems to be done. There are too many harmful insects bred in such a pile. Short rice and wheat left from the previous season's harvesting are turned under in plowing. Sometimes fields are allowed to lie fallow for a season.

Soil from the bottom of drained irrigation ponds and ditches and canals is taken out, dried and spread on the fields for fertilizer. As these waterways are often stocked with fish, much of such pond soil is rich in many of the nutrients needed to build up the soil.

Oilcakes are made from the refuse of soya and other beans and nuts, which have been pressed for oil, and are used as fertilizer.

The Chinese know the use of nitrogen-fixing plants.

Bone meal may be used for fertilizer sometimes, but more often it is used in foods instead.

Other methods of soil conservation

There is irrigation, especially in the wet-rice growing areas.

Farmers reclaim land from both desert and sea, and, as they can, from flooded rivers.

In some areas the farmers have used a primitive method of afforestation through the centuries. This holds springs and water for their rice fields long after the plains beneath denuded mountain areas have almost dried up in the drought.

Rotation of crops is rapid, rice fields being drained and almost immediately planted to vegetables, sweet potatoes or wheat. The fields look like gardens, exquisitely cared for, orderly and free from weeds. Vegetables are grown in mounds about nine to twelve inches high, level on top and sloping to the footpaths between for drainage. Sweet potatoes are grown in hills or ridges.

There is a kind of conservation of the soil in the direct consumption of vegetable products by human beings, as explained in the following excerpt.

"...The Chinese are noted for their slight dependence upon meat and animal products for food...In the main this is a saving. Whether it was entered upon intentionally as a matter of principle, gradually arrived at through more or less unconsciously recognized experience, or purely by accident, need not here concern us...To use the products of the field directly for human food without the waste of first passing them through the digestive processes of an intermediary animal obviously effects an economy in the area needed to support a given number of human beings. The Chinese diet has not been entirely lacking in meat. Most of it, however, has been derived from fish, which take up no land, and from pigs and chickens, which are in part scavengers and hence not a full charge upon food otherwise available for man."

(From Latourette, **The Chinese, Their History and Culture**, as above, P 566)

Historical

Agriculture was sanctioned by the emperor from early times in China. He plowed the first furrow of spring with a gold-handled plow, his retinue of lords and other nobility following his example, each plowing a furrow in turn.

The government has always tried to a) keep farming attractive to the people, b) discourage most of them from going into business and other competitive vocations.

The farmer is made second in the Chinese social scale, next to the scholar in rank.

There is a heavy penalty attached to the stealing of grain, which, out in open unprotected fields, is allowed to go to maturity in ripening. Fruits on the other hand, are anybody's

game, green or ripe. But most fruits, unless protected almost bodily, are not allowed to ripen. Someone picks them for market, or steals them to eat long before. Light or no penalty whatever is attached to stealing fruit. A fruit tree belongs to the person who planted it no matter on whose property it is.

Crops

The soils and climates of China vary as much as in the U. S. In the north the people are taller, more phlegmatic. There are more animals and more meat is eaten. Also the northerners raise many leafy vegetables, varied fruits and nuts. Grains here, as in the south, are the most important—millet, wheat, kaffir corn, a little rice; and legumes are next.

In the south the people are smaller, more fiery-tempered. There also there are grains, especially rice, but also wheat. Legumes, pigs, fish, poultry, fruits and vegetables of many kinds are raised. In a vertical mile in some parts of China one can see from bottom to top, vegetables, corn, wheat and a cap of rye.

Among the legumes, the soya bean varieties are most important. It is said that this bean furnishes the poor man's meat in the bean curd, and his milk, in the whey. Manchuria especially raises enormous quantities of the soya bean.

Waste and Losses

There is so much hard hand work done in the fields of China. It is estimated that the tilled soil is lifted by hand from two to five times a year to the depth of several inches. But in spite of all this hard work, few prosper. Always there is some starvation. Always millions exist at or below subsistence level. The philosophy of starvation is "If there were not wars and high mortality rates in diseases, how would the rest of us eat?" It is said that three successive crop failures in one area in China would cause tremendous political upheaval and unrest.

"The anxiety of the government to provide stores of food for the necessities of the people in times of scarcity shows rather the fear of the disastrous results usually following a short crop, such as the gathering of clamorous crowds of starving poor, and the consequent increase of bandits and disorganization of society, than any peculiar care of the rulers for their subjects, or that their store houses really supply deficiencies. The evil consequences resulting from an overgrown population are experienced in one or another part of the provinces almost every year; and drought, innundations, locust, mildew or other natural

causes, give rise to nearly all the insurrections and disturbances which occur. The influence from such events as well as from the prevalence of infanticide, the custom of selling the poor into domestic slavery, the existence of swarms of beggars and the bounty paid on the importation of rice, is confirmatory of a superabundant population. There can be no doubt, however, that without adding a single acre to the area of arable land, these evils would be materially alleviated, if the intercommunication of traders and their goods, between distant parts of the country were more frequent and safe. But this is not likely to be the case until both ruler and ruled make greater advances . . . government, obedience and regard for each other's welfare."

(From Williams **The Middle Kingdom**, Vol I, Wiley and Putnam, New York and London 1848 P 225)

At one time, when there was a crop failure, the people brought their plows and flung them down in front of the magistrate's palace as a mute expression of the impossibility of their paying the taxes.

Idle Earth

It is estimated that there is enough arable or reclaimable land in China to support twice the present population. Yet one hears that every inch of the arable land is under cultivation or in use for crops and raising animals. Even Marco Polo said this in his observations of the farming of China several centuries ago. I have heard Chinese students and others also parrot this oft-repeated remark. But sometimes, after a little investigation and observation, the contrary can be proved.

What about the vast areas in the so-called desert-like north that grow to grass not unlike the American prairies, where many thousands of animals could be raised? Large packing houses could be built in Manchuria to handle this meat and distribute it throughout China if communications were improved.

Vast areas are burned over every three years to rid the villages of predatory wild animals that the farmers have no time nor facilities otherwise to kill. This must also destroy the trees growing on the uplands.

Four to seven percent of arable land in China is given over to graveyards, and therefore is used mainly for ancestor worship. Also there are many unreclaimed areas, either of desert, sea or river valley, or just extremely fertile spots, like leaf-mold in richness, where no one has lived since some political uprising or other war has driven the people away or killed them off.

"There exist...within the eighteen provinces, vast areas of untilled land which with other methods of agriculture might be made available. The extensive regions of China are almost without cultivation and almost uninhabited. Vast reaches despoiled by the flooding of the Yellow River have never been reclaimed. Immense plains, sandy or semi-arid are to be found within the limits of the eighteen provinces."

(From Monroe's, **China, A Nation in Evolution**, The MacMillan Co., New York 1928 P 24)

"In China the notion of undistributed public goods distinct from private goods has never established itself in the general mind. The state has been tribute-taker rather than guardian of the general welfare, so the community is sacrificed to the individual, the public to the local group, and posterity to the living. Along the Wei River great quantities of quick-growing trees are scattered amid the crops while the mountains two or three miles away are denuded. Instead of growing their wood and fuel on the rough land which is good for nothing else, they grow it in their fields to the detriment of their crops, because, in the absence of public administration, the mountains are a no-man's land which all may ravage and abuse."

(From Ross **The Changing Chinese.** The Century Co., New York 1941 P 22)

There are many places in Fukien Province where quick growing trees could be raised for fuel, along the paths and roads, between the fields, and on the bare mountain slopes near Foochow. Sometimes the only tall trees not already cut down by the people or marauding soldiers can be seen on a mountainside on the paths or in the areas belonging to a monastery.

My Chinese friends argue that no one has time to do all this extra work of reclaiming land and raising animals and reforesting hillsides. But then the problem becomes one of introducing human factors into the situation and not one merely of lack of square inches of land. Many of the best brains and enterprising folk of the villages of south China have gone overseas for business, and while they do send back money to their families, thus enriching China, there are also many agricultural problems they could have helped to solve if they had remained at home and been given a little political peace over a period of time, in which to solve them.

Besides bad government and wars, other losses to agriculture are, excessive taxation, official feasts and orgies which, being mainly protein, deplete the meat and fish supplies of the

Chinese, never overabundant at any time. Ancestor worship, Buddhist teachings against killing and eating animals, and the status value of such foods as polished rice, delicate rice noodles and the like, also are detrimental factors in the food supply picture.

Under the Communists the land reform program, which was their most boasted form of help for the Chinese, failed dismally, even though they are enforcing it wherever possible. In Hinghua, for instance, years ago a missionary reclaimed a good many acres of land from the sea, raised crops on it and used them to feed the children in an orphanage established by the mission. Now the communists, after taxing that land in such a way it has been impossible to pay have confiscated the property, and reviled the mission as being the largest 'landlord' in the town.

In conclusion let me quote from Adolph *The Story of Chinese Food*, reprinted from the September 1925, issue of the American Food Journal.

"In short, all China is a study of the economics of the dinner table...It is evident that a country which has been experimenting in the simplest possible terms with one or two basic economic questions of life existence has an outlook and a fund of experience which is worthy of our study."

(Quoted from **Shanghai Evening Post and Mercury** 1947)
"Diminishing China National Currency returns"
An interesting study of what a CNC $100 bill has been able to buy in the last 10 years.

1937	2 cows
38	cow and calf
39	1 cow
40	1 calf
41	1 hog
42	1 ham
43	1 chicken
44	1 bag rice (150 lbs)
45	1 fish
46	1 egg
47	1/3 package matches
48	"God only knows what"

A VIEW OF THE CONFERENCE—1953

IDA GILBERT

Miss Gilbert, a former journalist, teacher and social worker from Toledo, Ohio, was born and lived as a child in Oklahoma. She has been one of the office helpers at the Bio-Chemical Research Laboratory of Dr. Pfeiffer for more than a year.

The B.D. Conference this summer was both a reassurance and a challenge. It was reassuring in its indication of the solu-

tions available for the world problem of food and population which is frightening many people today, and challenging in its outline of the work still needing support in order to be completed. Techniques related to the feeding of the masses of Asia, and also the needs of our mechanized Western agriculture, were discussed in detail.

In his opening talk, which dealt with the Orient, Dr. Pfeiffer stated that in the last thirty years more people in the Far East had died from infectious diseases than from famine. To solve this problem, he said, requires direct knowledge of the situation there. "We must gear our thought to see how we can work on the primitive level." He explained, further, that the difficulty was increased by the absolute ignorance of the average American of the problem. The primary interest of the peasant of the Far East is to survive. To raise the necessary food for his family, and that of the worker in the cities, who depends on him for food, the average farmer in the Orient has one to one and one half acres. He must use his own excreta, "night soil," as fertilizer. Even with it, he does not have enough.

The B.D. Method given by Dr. Steiner "lends itself ideally to this problem." It is not necessary to change the methods of the East so much as to re-direct them. The suggestion that the Orient needs American agricultural machinery is, according to the speaker, made only by those who do not understand the needs of the countries. Large machinery cannot be used on the small farms. To use the big machines it is necessary to collectivize the farms, thus giving the control to the State. "Russia used it to kill the spirit of the Russian peasant."

Worked by hand and with the B.D. Method, 600-800 pounds of vegetables can be raised on a plot 30x30 feet, enough for the eight to twelve people each farmer must feed (his family and one in the city). This way of working, using rows and ridges and juxtaposition of high and low-growing crops, has been followed successfully by Dr. Pfeiffer and others, and is described in detail in a B.D. book (at present out of print), "Grow a Garden and be Self-Sufficient." Dr. Pfeiffer also described how, on a half-acre wheat field, it is possible to "transplant and earth-en-up," so that the heads are heavier and the yield for the area as much as 500 times the normal.

As to the problem of the "night soil," Dr. Pfeiffer said he was convinced it had been solved, in terms of human health and safety as well as agricultural usability. Although large scale

tests in the Orient have had to be delayed, he has experimented here using rice hulls, a specialized B.D. Starter spray, etc. The result, in approximately six weeks, is good humus, completely safe to use.

As to the cultivation of the soil itself, Dr. Pfeiffer said the problem was essentially similar to that of any small gardener in Europe and America. The importance of proper moisture was stressed, and of understanding the difference between a soil, and also a compost, being moist enough and too moist. Dr. Pfeiffer indicated that to understand this difference was, in a real sense, to understand farming and compost. To assist in such an understanding, the Laboratory had prepared ten exhibits of soil, peat, manure and compost in various stages of moisture. For instance; soil from his Chester farm at 30% moisture is ideal, at 40% it is too moist to work and should not be touched until it dries out further. As a general rule it was advised not to cultivate earth that is moist enough to stick to the shoes or to the plough.

In discussing the compost, he explained that the result desired is *humus*, not merely broken down compost material, and the Laboratory is making this a quantitative science, for they are establishing exact formulas for breaking down the different materials. As a result of the articles in *Colliers* and other publications last Spring, more than 5,000 letters have come in from all over the United States and its possessions, and from fifty-eight foreign countries. These include letters from many industrial firms with various industrial wastes, the composting of which forms some of the problems the Laboratory is gradually solving.

One of the encouraging aspects of the Conference was the statement by Dr. Pfeiffer that there is a growing admission of the need of organic matter and composting, on the part of chemical experts. He pointed out that this was quite a change from the emphasis on industrially obtained Nitrogen. The primary cause of the original emphasis on such Nitrogen, in Germany, was that Nitrogen is needed for war explosives, and it is very difficult to store. As it can also be used, in different forms, for fertilizer, this was one reason why the B.D. Method was for a time even forbidden in Germany. The B.D. Method is based on an entirely different way of thinking from the mechanical method, he explained, making use of the natural methods of manufacturing fertilizer. Besides digestion, there is always a need of mastication, and the best at that are the earthworm,

the cow and the goat. They produce some of the best organic matter, though all animal manures can be profitably used for fertilizer.

If compost that is not properly digested, or products low in Nitrogen, are used on the soil the N in the soil is tied down. This is the cause of some crop failures even among B.D. farmers. The proper mastication and digestion has its place also in the production of compost from organic matter other than manure. At a field display the method of using stones in an old cement mixer was shown to illustrate the effectiveness of even such simple machinery in "chewing up" coarse organic matter.

Dr. Pfeiffer, in discussing wide aspects of the agricultural problem, said that those working for the use of the B.D. Method had the obligation to face the question raised by a leader in the industrial chemical field—What is to be done about an industry that now has some five million dollars invested in building and equipment, and over 300,000 people employed, not including thousands of highly trained chemists?

The other speakers at the Conference included Erica Sabarth, whose paper on *Plant Symbiosis* appears in this issue; Alice Heckel, who discussed the important question *When Does an Insect Become A Pest?;* and Evelyn Speiden, who gave a very interesting and stimulating lecture on B.D. Gardens and Homesteaders, illustrated with pictures of those who have solved, and are solving the problems involved. She also presented a fascinating and informative illustrated lecture on herbs.

Maybel M. Holmes, who has lived many years as a missionary in China, discussed the problems of the Chinese farmer. This paper also appears in the current issue. Her discussion gave some first hand information on aspects of the problem and its solution as presented by Dr. Pfeiffer, and showed clearly where the approaches outlined by him would work. She said that three crop failures in three successive years in any area will have political repercussions; and that as many as 81% of the population of a village may suffer from ascarid worms. Such people eat twice as much as a healthy person. The Chinese farmer suffers heavily from taxation. Wars have at times cost him taxes paid 70 years in advance, and under Communism a tax as high as 70% *in grain* has been collected to ship to Russia to pay for war supplies.

Peter Blaser discussed *The Small Holder in Europe.* He said that there a person's "desire to be his own man goes before

rational management or good living," while here the contrary is true. The European farms are less specialized, and have a relatively larger number of workers than in this country. They are more self-sufficient. Doing more work by hand, the farmer gets to know the soil as part of himself.

On the whole, the Conference emphasized the need, expressed by Dr. Pfeiffer, for the scientist, the farmer, and industrialists to sit down together so that the interests of truth are safeguarded, and with a primary concern for human health. If this is ever done, and the B.D. Method given its rightful place and support, it was evident from the exhibits and statistics of production from farms and gardens, and reports of experiments at the Bio-Chemical Research Laboratory, that the problem of nourishing food for all the people in all of the countries can be, and is being, solved.

Local, national and world-wide problems of the farm and garden did not occupy the entire time of those at the Conference. On Sunday, August 2nd, there was an *Artistic Evening* at which those present enjoyed a Eurythmy and Song Recital. The artists, who gave their services for the pleasure of an audience gathered from many parts of the country were: Lisa Monges, Eurythmist; Gina Palermo, Soprano; Hilda Deighton, Contralto; Margrit Selke, Speaker; Thomas Lanese, Violin; Charlotte von Brederlow, Piano; Paul Nordoff, Piano.

RECIPES

SPOON BREAD

¼ C cornmeal (yellow)
1 T butter
1 T sugar
1 t salt
2 eggs, yolks and whites beaten separately
2 C milk

Mix cornmeal and milk cold. Stir while bringing slowly to boiling point. Boil a few minutes. Add butter, sugar, salt and egg yolks. Lastly fold in stiffly beaten whites. Bake in hot oven for 30 minutes. Serve with a spoon from dish in which it was cooked.

PEANUT BUTTER SOUP

3 C milk
1 C hot water
½ C peanut butter
½ t nutmeg
2 T wholewheat flour
1 t salt, a little pepper

Mix flour with a little of the milk cold, heat the rest of the milk. Meanwhile mix peanut butter with hot water until smooth. Add all these and seasonings to hot milk. Boil three minutes and serve with crackers.
If preferred omit the nutmeg and add a chopped onion which has been fried in a little butter.

The Wholewheat Sponge Cake recipe in Summer 1953 Bio-Dynamics needs a correction. Mrs. Browne says the secret of getting a fluffy cake is to fold everything into the egg whites,–first sugar, then combined yolks and lemon juice, finally flour. Please make this note in your copy.

IN PAST ISSUES OF BIO-DYNAMICS you will find vital articles on such subjects as

How to Convert a Farm to Bio-Dynamics—3 articles

Bee Keeping—4 seasonal articles, books
Golden Acres Apiary
Bees on Grindstone Run

Weather—2 articles

Conservation Practices—Grazing
Rain
Use of Lime
Compost
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We regret that due to the passing of Mr. Alton L. Hall, his place of 2.35 acres near Huntington Beach, California, is for sale Mr. Hall has been a member of the Bio-Dynamic Farming & Gardening Association since 1939 but had worked his place organically since they moved there in 1934. Now Mrs. Hall would like to sell to someone who would continue to treat the soil well. Anyone interested may write her at 17331 Nichols St., Huntington Beach, California.

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